REMARKS

Claims 1-7, 10-15, 17-21, 23, 25-28, 30, 31, 34 and 35 are pending. By this Amendment, claims 1, 26, 30-31, and 34-35 are amended, no claims are canceled, and no new claims are added.

Support for the amendments to the claims can be found throughout the application as filed; for example, at page 8, lines 27-34 (paragraph [0043]) and FIG. 1. Therefore, no new matter has been added.

Telephone Interview Summary

Applicants thank the Examiner for the courtesy extended to Applicants' representatives in a telephone interview conducted on December 16, 2010. During the interview, claim 1 and the references cited in the most recent Office Action were discussed. In particular, proposed amendments to the claims related to the timing and location of the disturbance and the effect on the pair of the backscattered pulse copied were discussed. Although no particular agreement was reached regarding the claims, Applicants and their representatives thank the Examiner for his time and candor during the interview and now file this Amendment consistent with the interview discussion.

Response to Objections to the Claims

Claims 23 and 25 were objected to because of purported numbering formalities. Specifically, claim 23 depended from higher-numbered claim 35 and claim 24 depended from higher-numbered claim 34. Referring to MPEP § 608.01(n), subsection IV, which discusses

claim form and arrangement, "During prosecution, the order of claims may change and be in conflict with the requirement that dependent claims refer to a preceding claim. Accordingly, the numbering of dependent claims and the numbers of preceding claims referred to in dependent claims should be carefully checked when claims are renumbered upon allowance." Therefore, Applicants respectfully submit that the objection to the claim numbering formality be withdrawn and instead be handled appropriately at allowance.

Response to Rejections Under 35 U.S.C. § 103

Claims 1-4, 10-15, 17-18, 25-28, and 34-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Pub. No. 2003/0103211 to Lange et al. ("Lange") in view of U.S. Patent Application Pub. No. 2003/0011840 to Bryce et al. ("Bryce"). Claims 5-7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lange, Bryce, and further in view of U.S. Patent No. 7,110,667 to Reingand et al. ("Reingand"). Claims 19 and 21 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lange, Bryce, and further in view of U.S. Patent No. 4,885,462 to Dakin ("Dakin"). Claim 23 stands rejected under U.S.C. 103(a) as being unpatentable over Lange, Bryce, and further in view of U.S. Patent No. 5,982,791 to Sorin et al. ("Sorin"). Claim 20 stands rejected under U.S.C. 103(a) as being unpatentable over Lange, Bryce, Dakin, and further in view of U.S. Patent No. 4,855,915 to Dallaire et al. ("Dallaire"). Claims 30-31 stand rejected under U.S.C. 103(a) as being unpatentable over Dakin in view of Lange, and further in view of Bryce. These rejections are respectfully traversed, including insofar as they may apply to the amended claims.

Amended claim 1 now recites, in combination with the other elements of the claim, "using a temporal characteristic in the combination signal of received returned signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance to evaluate the position of the time-varying disturbance on the transmission link wherein the position of the disturbance is determined from the time of return of said phase-modulated backscattered components of said returned signal copies, the phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return." The method of amended claim 1 is not disclosed, suggested, or evidenced in the references cited in the Office Action, alone or when combined as suggested. In particular, Lange and Bryce fail to disclose, suggest, or include evidence of the "received returned signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance," the "the phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," as recited in amended claim 1.

Lange teaches "a fiber optic fault detector and generic fiber optic system for detecting breaks in an optical fiber using a low coherence interferometric technique." (Lange: Abstract.) Likewise, Lange discloses, referring to paragraph [0028], a system "to determine the total path length of the light traveling through the device." Both a break in an optical fiber and a total path length necessitate a crucial common thread: a path end point. Lange relies on finding this end point in order to operate. In the case of an intact fiber, the end point is the last point in the fiber at which light can travel before being reflected. Similarly, in the case of a break in an optical

fiber, the end point is the point at which the fiber is broken, thereby creating an artificial end point at which light can no longer travel before being reflected. Referring to Lange, paragraph [0044], "It should be noted that the two components of light passing through path (2) and light passing though path (3) will traverse identical distances." Thus, the light in Lange merely travels to the farthest point at which it can proceed (the break or path end point) and is reflected from that point back to a detector. (See Lange at para. [0043].) "This path length can be used to determine the length of an optical fiber or the location of a break in an optical fiber." (Lange: para. [0044].)

In contrast, amended claim 1 discloses a method of evaluating a position of a time-varying disturbance, not a break or a length. Compare a break or path end point, which are not time-varying disturbances, with the problem of time-varying disturbances, as explained in the application as filed on page 8, lines 4-12 (para. [0040]), "a physical disturbance (caused for example by a displacement, an acoustic or ultrasound wave or other vibration) is likely to result in a change in the transmission properties of an optical fibre or other optical link. In particular, a physical disturbance such as that cause[d] by a shock is likely to result in a time varying strain which will change the optical path length in the strained region of the light-carrying medium of the fibre (normally the silica glass core of the fibre), either through a change in the refractive index, polarization, or a change in the physical length, or a combination of these." Note that the change in physical length referenced here refers to the relative length of a particular disturbed section of fiber, not the total length of fiber measured in Lange. Accordingly, the system of Lange and the method of amended claim 1 do not measure the same aspect of transmission links.

As recited in claim 1, a temporal characteristic of "the combination signal of received returned signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance" are utilized to "evaluate the position of the time-varying disturbance on the transmission link" (Amended claim 1.) Thus, the optical pulse source light of claim 1 passes twice through the time-varying disturbance: once when it has traveled along the transmission link to beyond the location of the time-varying disturbance and once when has traveled on its return path back through the disturbance as received returned signal copies of a transmitted pair after being reflected by the path end point. Therefore, locating a path end point as required in Lange is independent of locating a disturbance location along a path as recited in amended claim 1.

This distinction is reinforced by language in the application as filed. Referring to page 8, lines 27-34 (paragraph [0043]) and FIG. 1: "After a time t1, returned backscattered components will have originated from pulses which have traveled beyond the position X. When the pulse copies or the backscattered components pass through position X, the phase of the backscattered components resulting from the pulse copies will be affected by the disturbance. Because the disturbance changes with time, the relative phase of the backscattered components of a given pair of pulse will be changed, resulting in a sharp change in the interference signal at the time t1. Likewise, returned components from the pulses which have traveled beyond X will also be affected."

Further, the modulation applied by Lange helps to draw out the distinction between amended claim 1 and Lange. The Office Action cites Lange as disclosing a shifted phase modulation due to a sensed disturbance on the link. However, in Lange, phase modulation is

applied to the sensing signals at a known location and not by a disturbance. Referring to Lange at paragraph [0044], "Moreover, light passing on these paths will receive identical modulations from modulator 116, although the modulation will be shifted in time by an amount related to the time delay for the beam to pass through the sensed device. Hence, the difference in modulations applied to the two beams is due to the time delay, which is related to the length of the device. By adjusting the modulation applied to account for this delay, the length of the path traversed by the beams can be calculated." Lange does not disclose or suggest using backscattered signal components whose phase-modulation is induced by the *disturbance*, and using this to detect the location of the disturbance which has caused the phase modulation in the manner of the invention presented in the amended claims.

Even if combined as suggested in the Office Action, Bryce fails to remedy the deficiencies of Lange because Bryce does not disclose, suggest, or include evidence of the "received returned signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance" as recited in amended claim 1. Therefore, amended claim 1 is allowable for at least these reasons. Claims 2-7, 10-15, and 17-21 depend from claim 1 and are therefore also now allowable. The rejections of claims 2-7, 10-15, and 17-21 are traversed but not expressly argued herein in view of the allowability of the underlying base claim.

Similar to amended claim 1, amended claim 26 now recites a phase change which "is caused by a time-varying disturbance, said interference signal stored in association with an indication of a temporal characteristic of the return signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance

enables the position of the disturbance to be determined from the time of return of phase-modulated backscattered components of said returned pulse signal copies, the phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," in combination with the other elements of the claim. Therefore, at least for reasons similar to those set forth above with respect to claim 1 and the deficiencies of Lange and Bryce, claim 26 is also now allowable. Claims 27 and 28 depend from claim 26 and are therefore also now allowable, the rejections of these claims being traversed but not expressly argued in view of the allowability of the underlying base claim.

Similar to amended claims 1 and 26, amended claim 34 now recites "return signals comprising backscattered components comprising at least partially returned copies of said signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance previously transmitted on said transmission link, wherein at least one of said backscattered components has suffered a phase change caused by said time-varying disturbance," the "phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," in combination with the other elements of the claim. Therefore, at least for reasons similar to those set forth above with respect to claim 1 and the deficiencies of Lange and Bryce, claim 34 is also now allowable. Claim 25 depends from claim 34 and is therefore also now allowable, the rejections of the claim being traversed but not expressly argued in view of the allowability of the underlying base claim.

Similar to amended claims 1, 26, and 34, amended claim 35 now recites "light received in the return direction comprises backscattered components of said combined signal copies of a

transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance originally transmitted in said outbound direction, wherein at least one of said backscattered components has suffered a phase change caused by said time-varying disturbance," the "phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," in combination with the other elements of the claim. Therefore, at least for reasons similar to those set forth above with respect to claim 1 and the deficiencies of Lange and Bryce, claim 35 is also now allowable. Claim 23 depends from claim 35 and is therefore also now allowable, the rejections of the claim being traversed but not expressly argued in view of the allowability of the underlying base claim.

Amended claim 30 now recites, in combination with the other elements of the claim, backscattered signal copies suffering a phase change, wherein the "phase change is caused by a time-varying disturbance, said interference signal stored in association with an indication of a temporal characteristic of the return signal copies of a transmitted pair which has traveled along the transmission link to beyond the location of the time-varying disturbance enables the position of the disturbance to be determined from the time of return of phase-modulated backscattered components of said returned pulse signal copies, the phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return." The system of amended claim 30 is not disclosed, suggested, or evidenced in the references cited in the Office Action, alone or in combination. In particular, Dakin, Lange, and Bryce fail to disclose, suggest, or include evidence of the "return signal copies of a transmitted pair which has traveled along the transmission link to beyond the location

of the time-varying disturbance," the "phase-modulated backscattered components including backscattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," as recited in amended claim 30.

Dakin, referring to FIG. 1, teaches an optical fiber sensing system utilizing "an optical fibre loop sensor 1, which will extend over a predetermined path which is to be monitored for determining a particular parameter acting at a specific point along the fibre sensor 1." (Dakin: col. 2, lines 4-7.) The system inherently requires a sensor loop in which light propagates in opposite directions. (See Dakin: Abstract.) "Optical interference between these light signals propagating in opposite directions around the loop sensor 1 enables a phase change (x) between the two opposite loop paths to be monitored by the optical detector 4." (Dakin: col. 2, lines 12-16.) Thus, the light signals of Dakin pass through any disturbance only once as light proceeds in opposite directions along the loop.

In contrast, the system of amended claim 30 does not require a loop-oriented fiber under test and instead utilizes reflected return signal copies that have initially traveled to beyond the location of a disturbance and are secondarily reflected back through the disturbance. The Office Action concedes that Dakin does not disclose a processor circuit arranged "to store the interference signal in association with an indication of a temporal characteristic of the return signal, wherein, when said phase change is caused by a time-varying disturbance, said interference signal stored in association with an indication of a temporal characteristic of the return signal enables the position of the disturbance to be determined from the time of return of phase-modulated backscattered components of said returned pulse signal copies," as well other elements of the claim. The Office Action argues that a person of ordinary skill in the art working

with Dakin would have been motivated to combine Dakin with Lange and Bryce to achieve the sensing system of claim 30. However, at least for the reasons set forth herein with respect to each of these references, the references, whether taken alone or when combined as suggested in the Office Action, still fail to disclose or suggest each and every element of claim 30. Therefore, amended claim 30 is allowable for at least these reasons.

Similar to amended claim 30, amended claim 31 now recites "(iv) inferring the position of the vehicle from the position of the disturbance along the optical transmission link, wherein the position of the disturbance is determined from the time of return of phase-modulated backscattered components which have traveled along the optical transmission link to beyond the location of the time-varying disturbance, the phase-modulated backscattered components including back-scattered components of a given pair of pulse copies that are phase-modulated by the disturbance on return," in combination with the other elements of the claim. Therefore, at least for reasons similar to those set forth above with respect to claim 30 and the deficiencies of Dakin, Lange, and Bryce, amended claim 31 is also now allowable.

Conclusion

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,

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